15 The Relationship Between Macroeconomic Variables and Budget Deficit: A Comparative Study of Sri Lanka with Malaysia and South Korea

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15.1 Introduction

Year on year, striving for a balanced budget is a thorny question everywhere. For economic stability, countries need to reduce longstanding, sizable budget deficits and strive to maintain this as a trend. A country's unfavourable welfare trends are generally associated with balancing the budget and politically popular decisions. In general, the government budget is used to assess the fiscal health of a country. It is further differentiated by closely related terms of the primary balance and structural balance (also known as cyclically adjusted balance) of the government. The primary budget balance is the government budget balance before interest payments. The structural budget balance attempts to adjust the impacts of real GDP changes in the national economy (Dissanayake 2016).

Macroeconomic stability is a crucial component in meeting sustained growth and, along with reducing the size of the budget deficit, is a major determinant of economic stability. To maintain macroeconomic stability, economic policymakers need to consider current economic issues, historical trends and potential threats and future benefits. The budgetary process is multi-dimensional processes with many economic variables that affect the outcome and also depend on the country's economic behaviour.

Empirically, however, budget deficits are more common than a balanced budget internationally and locally for various economic reasons. This makes it important to study the impact of macroeconomic instability on an unmanageable, sizable, sustained budget deficit, identifying the selected macroeconomic variables (inflation, interest rates, exchange rates, real GDP growth rate and debts) and their relationship

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to the budget deficit, and determine the potential of countries to achieve macroeconomic stability in the long term.

15.1.1 Budget Deficit Records

15.1.1.1 Sri Lankan Government

From 1980 to 2016, the Sri Lankan government budget deficit averaged 8.65% of GDP, with a record high of 19.20% in 1980. In 2017, the deficit increased to 5.5% from 5.4%, which was recorded in 2016 as a result of worsened government revenue collection. But in 2017 it represented a reduction in total government expenditure to 19.4% (% of GDP; see Fig. 15.1).

In 2017, the overall budget deficit of Rs.733.49 billion was financed largely through foreign sources (mainly international sovereign bonds (ISBs), foreign currency term financing facility (FTFF), T-bonds and T-bills). This foreign financing stood at Rs. 439,243 million (3.3% of GDP), and net domestic financing (2.2% of GDP) amounted to Rs. 294,251 million (CBSL annual report 2017).

15.1.1.2 International Trend

Malaysia recorded a government budget deficit equal to 3.20% of GDP in 2015. The budget averaged −3.0% of GDP from 2000 to 2015. South Korea recorded a deficit equal to 3% of GDP in 2015; the budget averaged −0.30% of GDP from 2000 to 2015 (IMF Factbook 2014).

In the 2000–2015 period, the global financial crisis of 2007–2008 is considered by many economists as the most terrible financial crisis after the Great Depression of the 1930s: many countries experienced their highest budget deficits in 2009 and 2010. In 2009 budget deficits (% of GDP) were the USA 13.3%, Ireland 7.3%, Greece 15.6%, Portugal 10.2%, Spain 11.2%, Japan 10.4%, and India 10%, and in 2010 the USA 11.2%, Ireland 30.9%, Portugal 9.8%, Spain 9.4%, Japan 9.4%, the UK 9.9%, and India 10% (IMF Factbook 2014).

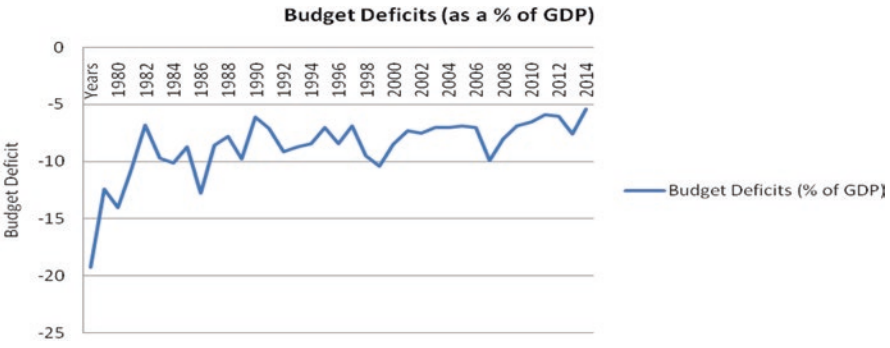

Fig. 15.1 Budget deficit record in Sri Lanka, 1980–2016. (Source: Author's analysis)

15.1.2 Impact of Budget Deficits on Economic Stability

A country with a larger budget deficit may struggle to attract sufficient foreign investors to buy government bonds. If this occurs, the Central Bank needs to print money to buy bonds, but, unless the economy is in a liquidity trap, printing money will cause inflation and reduce the value of savings. When a government tries to finance its large deficit domestically, the remaining reduced funds for private investment will lead to 'crowding out' in the private sector. Attraction of new investors to buy government bonds is required to increase the bond yield rate. This may lead to spending a higher amount of national income on debt interest repayment and will result in a larger deficit. When the budget deficit is above a certain level, national debt tends to increase on for deficit financing.

A sizable, sustained budget deficit may cause macroeconomic instability. According to Keynesian analysis, maintaining a sizable budget deficit during a recession will lead to increased aggregate demand, because, in a recession, private consumption and investment fall and increasing government expenditure are the only way to 'kick start' the economy. Hence government spending can help promote economic growth, which will enable collection of tax revenue from households and firms such that the deficit will fall over time. If a country tries to maintain a balanced budget during a recession, this can make the recession deeper. During such times there can be good reasons to run a deficit budget – at least for the short term (Keynes 2007).

15.1.3 Rationale

Macroeconomic stability can be measured by the volatility of key indicators: inflation, real GDP growth rate, changes in unemployment, fluctuations in the current account of the BOP (balance of payments), the size of the deficit, volatility of short-term policy interest rates and long-term interest rates such as the yield on government bonds and stability of the exchange rate in the currency market (Adam and Bevan 2005).

Macroeconomic stability provides a framework for improved supply-side performance and maintains that this is essential for healthy economic growth. Stable low inflation encourages higher investment, which is a determinant of improved productivity and non-price competitiveness. Controlling inflation also helps maintain price competitiveness for exporters and domestic businesses facing competition on imported goods. Maintaining the exchange rate helps international business confidence and also government debt servicing. The maintenance of short- and long-term low interest rates is important for private investment and will reduce the interest costs of those with mortgages and businesses with loans to repay. A stable real economy helps anchor a country's stability expectations, which can act as an incentive to attract inflows of foreign direct investment (Dornbush and Fisher 1994).

Impact of causes of and factors in macroeconomic instability have always been of great interest for researchers. Keynes's (2007) concept is based on the principle

that the market economy is unstable and incapable of self-regulation. It requires external influences and regulation by the government, especially when the economy is in a recession or depression. It is the government's role to ensure macroeconomic stability by controlling aggregate demand and decide the amount of government spending, tax rates, and amount of money supply in the economy.

Macroeconomic instability may distort sustained growth: high or unstable inflation threatens economic growth, and high inflation alters the value of long-term contracts; volatile inflation creates uncertainty in the market and increases risk premiums, and, since many tax rates are adjusted by average inflation, volatile inflation can severely impact government revenue and individual liabilities. Higher national debt also points to government inflexibility in using tax revenue to address domestic needs instead of paying foreign creditors, whereas a low national debt permits lenient fiscal policy in a time of crisis. The Maastricht criteria cap that debt level at 60% of GDP. When the budget deficit is high, growth of national debt accelerates. The Maastricht criteria also cap the deficit needed at 3% of GDP. Real exchange rate stability allows importers and exporters to develop long-term growth strategies and reduces exchange rate risk for investors. In national accounting, a stable currency reduces the threat (currency depreciation) posed by the debt issue in terms of foreign currency. The Maastricht criteria permit exchange rate fluctuations of at most 2.5%. Increase of the exchange rate gap and increase of foreign exchange fluctuation cause increased risk and uncertainty in market decision-making. All these factors decrease the real growth of an economy in the short run (EMI Annual Report 1994). Put simply, the variables of budget deficit, inflation, interest rates, exchange rates, real GDP growth rate, current account deficit, debt and unemployment in an unmanageable situation represent macroeconomic instability.

Although numerous factors contribute to macroeconomic stability, policymakers can influence some of them in the short run. Proposing structural changes to deal with long-run stability may be of importance. The major issues for policymakers, in the context of a potential link between reducing the budget deficit and macroeconomic stability, are as follows: How to stimulate investment? How to increase the level of savings to lend funds for investment needs? How to attract foreign flows and maintain bilateral investment? How to manage international trade and the issues related to international trade? How to maintain an optimal level of interest rates? How to maintain an optimal level of exchange rates? How to control inflation to maintain price stability? How to maintain optimal debt levels? How to achieve sustained high economic growth? And how to raise the public's quality of life?

15.1.4 Research Questions

How do the selected macroeconomic variables influence the budget deficit in Sri Lanka? How do they influence the budget deficit in Malaysia? How do they influence it in South Korea? How do the variables negatively impact macroeconomic instability? And how do these circumstances affect achievement of high economic growth?

15.1.5 Problem Statement

Widening budget deficits have become a major concern, because of adverse impacts on macroeconomic instability. There are no guidelines for policymakers about the level of budget deficit that must be maintained. Therefore, there is a possibility of increasing budget deficit size to a level detrimental to macroeconomic stability, which might pose a greater risk of insolvency or, even worse, bankruptcy in the future. A country's lack of threshold levels to serve as guidelines in maintaining and reducing a budget deficit may lead to loss of control of the fiscal position.

15.1.6 Objective

The main objective of this study is to investigate selected macroeconomic variables' relationship to the budget deficits in Sri Lanka, South Korea and Malaysia from 2000 to 2016.

15.1.6.1 Specific Objectives

- To study the effect of budget deficit on selected macroeconomic variables in Sri Lanka, South Korea and Malaysia from 2000 to 2016;
- To undertake a comparative study; to identify the selected macroeconomics variable's relationship to the budget deficit during the post-liberalization era (2000–2016).

15.1.7 Hypotheses

The following null hypotheses are tested in the study of the Granger Causality test:

- H1: Inflation does not have any significant relationship to budget deficit.
- H2: Interest rate does not have any significant relationship to budget deficit.
- H3: Exchange rate does not have any significant relationship to budget deficit.
- H4: Real GDP growth rate does not have any significant relationship to budget deficit.
- H5: Debt does not have any significant relationship to budget deficit.

The following hypotheses are tested in the study of the Hausman test;

- H6: The random-effect model is appropriate.
- H7: The fixed-effect model is appropriate.

15.1.8 Importance of the Study

In open economies, significant macroeconomic problems are liable to cause an unmanageable, sizable budget deficit, and ultimately this will lead to an economic crisis. The importance of the study is for making decisions on the level of future spending, national debt-level reduction and the opportunity cost of debt interest

repayments, and for identifying possible pressures on inflation. The potential economic costs of budget deficits depend on economic climate, the exchange rate system, domestic interest rates and government borrowings, and finding solutions for these issues and maintaining a stable growth rate, which are even more important. Two Asian countries, South Korea and Malaysia, were selected as maintaining a lower budget deficit level in order to identify how to implement these two country's macroeconomic variables might positively impact on Sri Lanka's economic growth.

15.1.9 Limitations

The study involves a very complex array of relationships, and for study purposes it will be necessary to narrow the focus to a limited number of macroeconomic determinants of the budget deficit: inflation, interest rates, exchange rates, real GDP growth rate and debt. The main study also selected only 16 years (2000–2016) to minimize the macroeconomic variables' cyclical effect (if any). Further, it assumes error terms are uncorrelated when considering time series data.

15.2 Literature Review

A deficit budget is when government expenditure outweighs revenue. Fiscal policy is concerned with raising revenue through taxation and deciding the level of expenditure for economic activity. Fiscal policy decisions will affect achievement of certain desirable macroeconomic goals (Anyanwu 1993). Most studies suggest that inflation, interest rates, exchange rates, real GDP growth rate and debt cause budget deficits (and vice versa for reducing deficits).

The relationship between budget deficit and macroeconomic variables is one of the most widely debated topics among economists and policymakers in developed and developing economies. Budget deficit and these macroeconomic variable relationships can either be negative or positive (Saleh 2003).

In each period, the government must finance its planned expenditure and also pay any debt interest. For financing its expenditure, the government can use taxation or deplete fixed assets, sell new bonds or print money; one of these (and others) may be considered. In nominal terms, the government budget identity in each period can be written as Eq. 15.1:

$$G + iB \equiv T + \Delta B \tag{15.1}$$

where G is government expenditure on goods and services in nominal terms; i, nominal interest rate; B, outstanding stock of bonds; T, tax revenue; and ΔB, value of new bonds issued in the current period (Carlin and Soskice 2013). Equation 2.1.1 is constructed considering the government budget of the expected revenue and level of expenditure.

Equation 15.2 is defined to identify the government debt level, relative to national income. We, therefore, write the equation:

$$\text{Gove}^{n}\ \text{debt to GDP ratio} \equiv b = \frac{B}{Py} \tag{15.2}$$

where b is government debt-to-GDP ratio; B, government debt; P, price level; y, real national income; and Py, nominal national income (nominal GDP).

If the government decided to increase the money supply when the budget is not in equilibrium by selling government bonds or manipulating interest rates or printing money, this can be changed or increased via high-powered money (ΔH); by adding high-powered money to the right-hand side of Eq. 15.1, we can construct Eq. 15.3 as:

$$G + iB \equiv T + \Delta B + \Delta H \tag{15.3}$$

$$\Delta B \equiv (G - T) + iB - \Delta H$$

$$\frac{\Delta B}{Py} = \frac{(G-T)}{Py} + \frac{iB}{Py} - \frac{\Delta H}{Py} \qquad \text{dividing by nominal GDP}$$

$$\frac{\Delta B}{Py} = d + ib - \frac{\Delta H}{Py} \qquad (\text{A})$$

Where $\frac{B}{Py} = b =$ Gov^{n} debt to GDP ratio, $\frac{(G-T)}{Py} = d =$ Primary budget deficit to GDP ratio $B = b.\ Py$ from Eq. (15.2)

$$\Delta B \approx \Delta bPy + b\Delta Py + bP\Delta y$$

$$\frac{\Delta B}{Py} = \frac{\Delta bPy}{Py} + \frac{b\Delta Py}{Py} + \frac{bP\Delta y}{Py}$$

$$\frac{\Delta B}{Py} = \Delta b + b\pi + b\gamma_{y} \qquad (\text{B})$$

where $\Delta P/P = \pi$= rate of inflation, $\Delta y / y = \gamma_{y} =$ growth of real output

When (A) = (B)

$$d + ib - \frac{\Delta H}{Py} = \Delta b + b\pi + b\gamma_{y}$$

$$\Delta b = d + (i - \pi)b - b\gamma_{y} - \frac{\Delta H}{Py}$$

$$\Delta b = d + (r - \gamma_{y})b - \frac{\Delta H}{H}.\frac{H}{Py}$$

where $(i - \pi) = r$= real interest rate,$M = kH$, M = broad money, H = High powered money, k(kappa) = banking multiplier

$$\Delta b = d + \left(r - \gamma_y\right)b - \gamma_H h \tag{15.4}$$

When $\Delta H / H = \gamma_H =$ growth rate of high powered money

$H / Py = h =$ ratio of high powered money to nominal GDPWhere Δb= growth of the debt to GDP ratio, b= ratio of government debt to GDP

Equation 15.4 provides a powerful way of understanding the relationship of the five key determinants of growth of debt-to-GDP ratio (Δb): (1) primary budget deficit ratio (d); (2) real interest rate (r); (3) growth of real GDP (γ_y); (4) ratio of government debt to GDP (b); and (5) growth of high-powered money (γ_H) (Carlin and Soskice 2013).

15.2.1 Budget Deficit and Selected Macroeconomic Variables

15.2.1.1 Budget Deficit and Inflation

The relationship between budget deficit, money supply and inflation is analysed as follows. Increase in monetary base balance, leading to increase in money supply, will result in more general inflation. Price growth tends to decrease the real value of money and forces the government to increase subsidies, which leads to an increase in the size of the budget deficit (Chimobi and Igwe 2010).

Devapriya and Masaru (2012) in a Sri Lankan study identified that budget deficit and inflation have a positive relationship, and there is a bi-directional causality between budget deficit and inflation. Their study suggests the main determinants of inflation rate are budget deficit, growth of money supply, interest rates and real exchange rates.

15.2.1.2 Budget Deficit and Interest Rate

Al-Khedir (1996) studied the relationship between budget deficit and macroeconomic performance of G7 countries for the period 1964–1993 using vector autoregression. He found a deficit budget that led to higher short-term interest rates. However, deficits did not manifest any impact on long-term interest rates. Knoester and Mak (1994) showed that only in Germany (of eight OECD economies) did government budget deficit contribute significantly to explanation of higher interest rates.

15.2.1.3 Budget Deficit and Exchange Rate

Krugman and Venables (1995) and Sachs (1985) argued that lower budget deficits lower the value of the dollar. Feldstein (1986) points out that appreciation of the dollar in the 1980s coincided with a high budget deficit; this study started a debate on the efficacy of cutting the budget deficit in the USA to strengthen the dollar. A similar phenomenon has been found in Canada by Wijnbergen (1989) where 'budget deficit contributed to an appreciation of the Canadian dollar'.

15.2.1.4 Budget Deficit and Real GDP Growth Rate

Ezeabasili et al. (2012) examined the relationship between economic growth and fiscal deficit in Nigeria. They utilized co-integration and structural method for 36 years (1970–2006) and revealed a negative effect of budget deficit on economic growth. Similarly, Fatima et al. (2012) investigated the consequential effect of budget deficit on the economic growth of Pakistan, using time series data for 31 years (1978–2009), also showing a negative impact of budget deficit on economic growth and suggesting that government should avoid a certain level of deficit to achieve a desired level of growth.

15.2.1.5 Budget Deficit and Debt

The national debt is the total amount of money payable by the government for goods and services bought but not paid for. As with the budget deficit, there are a number of views in regard to the national debt. When a government runs a budget deficit, meaning it spends more than it receives, in order to fund for this spending, the government needs loans. Mostly government finances its deficit by selling bonds. To sell bonds, the government must offer an interest rate which is attractive to investors. When the government increases the interest rate to finance the budget deficit, the debt-service level tends to increase. Financing the deficit in this manner may end with a debt trap (Michael 2011).

The government budget identity Eq. 15.1 shows the sources of the funds in any period to pay for the government's expenditure on consumption, transfers and investments and paying on debt servings (Carlin and Soskice 2013):

$$G + iB \equiv T + \Delta B$$
$$\Delta B = \left(G - T\right) + iB$$

Change in debt = primary deficit + interest on outstanding debt
Change in debt = actual deficit

$$\Delta b = d + \left(r - \gamma_y\right) b \tag{15.5}$$

Δb = change in debt to GDP ratio, d = primary deficit ratio, r = real interest rate, γ_y = grouth of real GDP, b = ratio of government debt to GDP.

The government's intertemporal budget identity can also be interpreted as to its solvency constraint and as a requirement for the absence of default risk on its debt. Also, there is a focus on the conditions necessary for the debt ratio not to increase zero $\Delta b \leq 0$:

$$\Delta b = d + \left(r - \gamma_y\right) b \tag{15.6}$$

$$\Delta b \leq 0$$

$$b \leq \frac{-d}{r-\gamma_y}$$

$$\frac{\text{Gov}^n \text{ Debt}}{\text{GDP}} = \frac{\text{primary budget surplus ratio}}{\left(r-\gamma_y\right)}$$

In order to interpret the budget constraint, we need to consider each variable's long-run value. For long-run sustainability, with an excess of expected long-run growth rate to give long-run real interest rates, there must be a long-run primary surplus if the debt-to-GDP ratio is constant (Carlin and Soskice 2013).

Dayarathna-Banda and Priyadrasanee (2014) have said Sri Lanka's public debt is not sustainable, so a change is required from foreign debt to other sources of financing for deficit reduction. In Sri Lanka, GDP growth rate, budget deficit, political instability and time trend positively affect increase of debt (Deyshappriya 2012). Financing the budget deficit by reducing the debt ratio and increasing the tax ratio is going to be a formidable challenge in the future development of Sri Lanka (Amirthalingam 2011/2012).

15.3 Methodology

This paper examined two different aspects to identify the nexus between selected macroeconomic variables and the budget deficit. Initially, the Granger Causality test was carried out to determine whether the selected variables' impact on budget deficit was uni- or bi-directional for Sri Lanka, Malaysia and South Korea, using annual time series data (2000–2016). Secondly, a comparative study used panel analysis for Sri Lanka, Malaysia and South Korea from 2000 to 2016. This utilized the Hausman test to identify the most suitable model between of the fixed-effect or random-effect models. The random effect's assumption is that the individual-specific effects are uncorrelated with the independent variables. The fixed effect's assumption is that the individual-specific effects correlate with the independent variables. The Durbin-Wu-Hausman test is often used to discriminate between the fixed and the random-effects models. All the non-stationary data were converted to a stationary level and employed EViews 9.5 econometric software for the data analysis.

Malaysia and South Korea were the two countries selected for the comparative analysis with Sri Lanka. The reason was that South Korea had the fourth-largest and Malaysia the third-largest economies in the Asian and Southeast Asian regions (respectively). They also maintained a lower budget deficit level and served to identify macroeconomic variables' positive impact applicable to Sri Lankan growth.

15.3.1 Data Collection

The secondary data collected for time series and panel data were obtained from the IMF international financial statistics database, World Bank data and a series of Central Bank of Sri Lanka annual reports. The economic interrelationships were grounded in theories extracted from relevant journals and textbooks. The study focused especially on macroeconomic variables during the post-liberalization period.

15.3.2 Model Specification

The proposed multiple regression model is to learn more about the relationship between selected independent variables – inflation (Inf), interest rate (r), exchange rate (ER), real GDP growth rate (y^g) and debts (debt) – and the budget deficit (Bd) as a dependent variable. Incorporating these explanatory variables, the budget deficit model specified in a linear form becomes:

$$Bd_{it} = \chi_0 + \chi_1 \inf_{it} + \chi_2 r_{it} + \chi_3 \mathrm{ER}_{it} + \chi_4 y^g_{it} + \chi_5 \mathrm{debt}_{it} + \phi_{it} \tag{15.7}$$

where Bd = budget deficit as a % of GDP
Inf = rate of inflation; point to point price change %
r = 91 days T' bill rate, %
ER = US dollar exchange rate index
y^g = real GDP growth rate
debt = sum of cumulative domestic and foreign debts as a % of GDP
t = time (starting; 1980–2016 and 2000–2016)
i = indices for individuals
x_0 = intercept term (assume error terms are uncorrelated)
ϕ_{it} = error term
$\sum_{a=1} x_a$ = coefficients

15.3.3 Granger Causality Testing

The Granger Causality test was carried out to determine whether the variable impacts were uni- or bi-directional. In fact, bi-directional causality may be valid for both series (see Abrego and Ross 2001; Sinha et al. 2011).

Simply put, the Granger Causality test is to represent six time series variables (budget deficit (Bd), debt (debt), exchange rate (ER), inflation (inf), interest rate (r) and real GDP growth rate (y^g)). The initial study concentrated on only two variables: budget deficit and inflation. Inf is said to cause Bd, if Bd can be better predicted using the histories of both inf and Bd than it can by using the history of Bd alone. Consequently, to determine the direction of causation between both series, the paper

specifies regression models for the data series, which may be written more compactly as follows:

$$Bd_t = \alpha_1 + \sum_{i=1}^{k}\beta_{1i}Bd_{t-i} + \sum_{i=1}^{k}\lambda_{1i}\inf_{t-i} + \sum_{i=1}^{k}\mu_{1i}r_{t-i} + \sum_{i=1}^{k}\delta_{1i}\mathrm{ER}_{t-i} + \sum_{i=1}^{k}\rho_{1i}y^{g}{}_{t-i} + \sum_{i=1}^{k}\sigma_{1i}\mathrm{debt}_{t-i} + \varepsilon_{1i} \quad (15.8)$$

$$\inf_t = \alpha_2 + \sum_{i=1}^{k}\beta_{2i}Bd_{t-i} + \sum_{i=1}^{k}\lambda_{2i}\inf_{t-i} + \sum_{i=1}^{k}\mu_{2i}r_{t-i} + \sum_{i=1}^{k}\delta_{2i}\mathrm{ER}_{t-i} + \sum_{i=1}^{k}\rho_{2i}y^{g}{}_{t-i} + \sum_{i=1}^{k}\sigma_{2i}\mathrm{debt}_{t-i} + \varepsilon_{2i} \quad (15.9)$$

If $\sum_{i=1}^{k}\lambda_{1i} = 0$ then inflation does not Granger-cause budget deficit as in Eq. 15.7, and when $\sum_{i=1}^{k}\beta_{2i} = 0$ budget deficit does not Granger-cause inflation as in Eq. 15.8.

Causality was then examined between budget deficit and the component of inflation using Eqs. 15.7 and 15.8. If the budget deficit Granger-causes inflation, then inflation becomes a dependent variable, following Bandiere (2008) and Sinha et al. (2011). In each case, when probability value is less than 5%, a rejection of the null hypothesis implies there is a uni-directional causality from independent to dependent variable.

15.4 Data Analysis

15.4.1 Empirical Analysis for Sri Lanka, 2000–2016

This section discusses the empirical analysis for selected variables for Sri Lanka from 2000 to 2016. Figure 15.2 presents all selected variable behaviour at the stationary level.

15.4.2 Lag Selection Criterion for Sri Lanka, 2000–2016

According to the lag selection criterion, the lowest AIC (Akaike info criterion) and SC (Schwarz criterion) values mean a model is the best, and we utilize that lag model for the data analysis. According to Table 15.1, the lowest AIC and SC values belong to the Lag (2) model; we therefore applied the Lag (2) model for data analysis.

The probability values in Table 15.2 help identify the relationship between debt and the budget deficit. In this table, the probability value of 0.0216 is less than 0.05; hence we conclude that budget deficit Granger-causes debt (after rejecting the null hypothesis). Likewise, the rest of the findings suggested that there were uni-directional relationships between budget deficit and other selected variables: interest rate Granger-causes budget deficit, and inflation Granger-causes budget deficit. The study also identified a relationship between independent variables: debt Granger-causes real GDP growth rate, and interest rates Granger-cause inflation in Sri Lanka (see Table 15.10, Appendix 3).

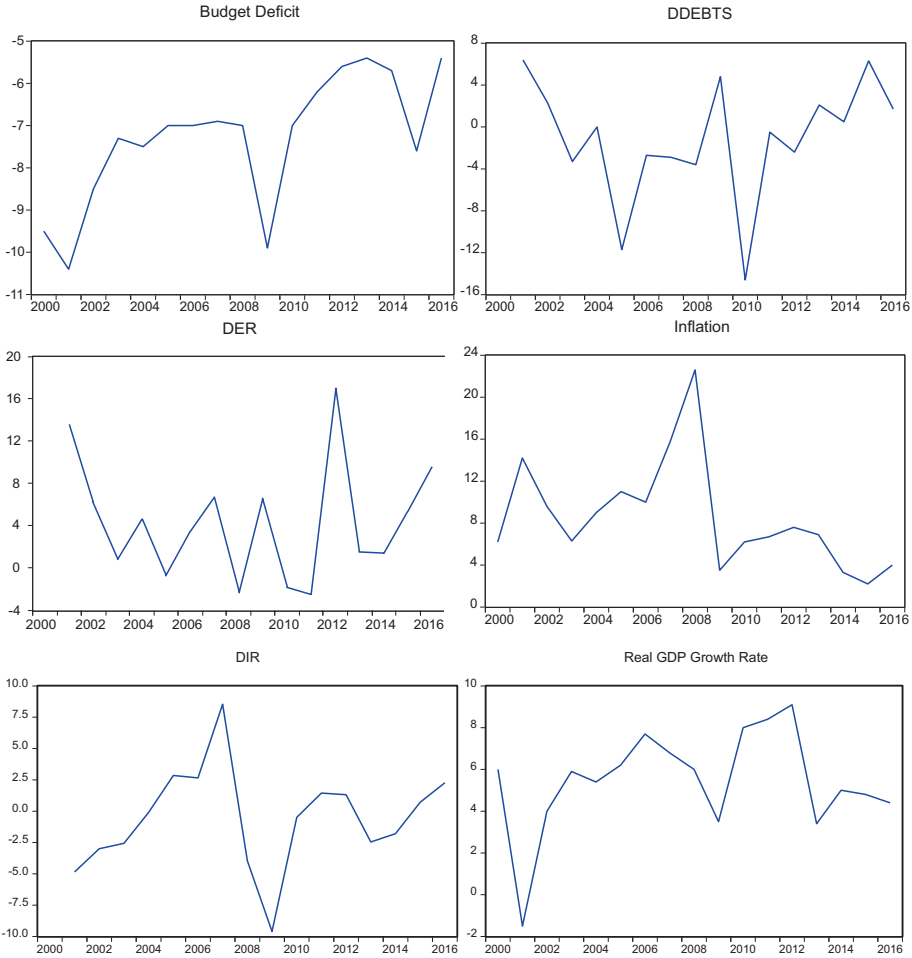

Fig. 15.2 Variables behaviour for Sri Lanka: 2000–2016. (Source: Estimates from E-Views Econometric package)

Null hypothesis (Ho) = Budget deficit does not Granger-cause debt
Alternative hypothesis (H1) = Budget deficit does Granger-cause debt

15.4.3 Debt Obligation Analysis for Sri Lanka, 2000–2016

Over recent decades, Sri Lankan government debt-to-GDP ratio remains high: during the 1988–1989 and 2001–2004 periods, it increased by 100%. The government debt-to-GDP ratio increased to 78.8% in 2016, amounting to Rs. 9387 Bn. The government debt-to-GDP ratio increased to 77.6% in 2017, amounting to Rs.10,313 Bn. Concessional loans declined to 49.6% in 2016, from over 90% before 2007, and this led to an increase in debt accumulation (CBSL annual report 2017).

Table 15.1 Comparison of Lag (1) and Lag (2) models

	Lag (1)	Lag (2)
AIC	30.12	0.31
SIC	32.13	0.91

Source: Author's analysis

Table 15.2 Pairwise Granger Causality test – Sri Lanka, 2000–2016

Null hypothesis:	Obs	F-statistic	Prob.
DDEBTS does not Granger-cause BUDGET_DEFICIT	14	0.24862	0.7851
BUDGET_DEFICIT does not Granger-cause DDEBTS		6.05289	0.0216

Source: Estimates from E-Views Econometric package

According to Fig. 15.3, domestic debt, the payment obligation will be at a high level from 2017 to 2020. Also, the foreign debt payment obligation will be at a higher level from 2017 to 2027 (see Fig. 15.4). When we consider the national debt payment obligation, the highest amount of service will be from 2107 to 2025. Because of these higher debt service obligations, Sri Lankan government policy-makers need to be more concerned when they take future policy decisions, especially on borrowing.

Because of higher debt, the ratio of debt service repayments to government revenue increased to 87.5% in 2017 from 80.2% in 2016 (CBSL Annual Report 2017) (see Table 15.3 for debt service payment comparative analysis).

15.4.4 Empirical Analysis for Malaysia, 2000–2016

In this section, the paper evaluates empirical analysis for the selected macroeconomic variables and the budget deficit for Malaysia from 2000 to 2016. Figure 15.5 presents all selected variables' behaviour at the stationary level.

15.4.5 Lag Selection Criterion

According to Table 15.4, the lowest AIC (Akaike info criterion) and SC (Schwarz criterion) values belong to the Lag (2) model, and we therefore selected the Lag (2) model for data analysis in the study.

There were no relationships revealed between budget deficit and the selected macroeconomic variables. Nevertheless, the findings confirmed the relationship between the independent variables. In Table 15.5, the given probability values are 0.0161 and 0.0424, and both values are less than 0.05 (5%), and thus we reject the null hypothesis and conclude that inflation Granger-causes debt and debt Granger-causes inflation. This represents a bi-directional Granger-cause situation. Likewise, the other findings suggest that there was a uni-directional causality between inflation and interest rates: inflation Granger-causes interest rates (see Table 15.11, Appendix 3).

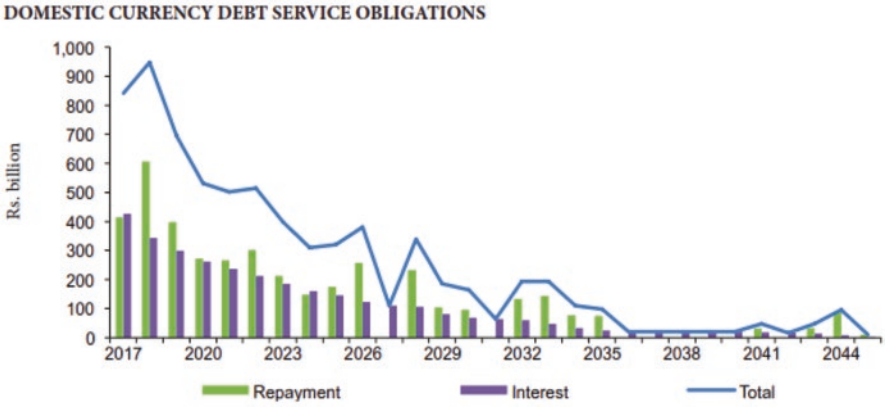

Fig. 15.3 Domestic currency debt service obligations. (Source: Public Debt Department, CBSL- 2017)

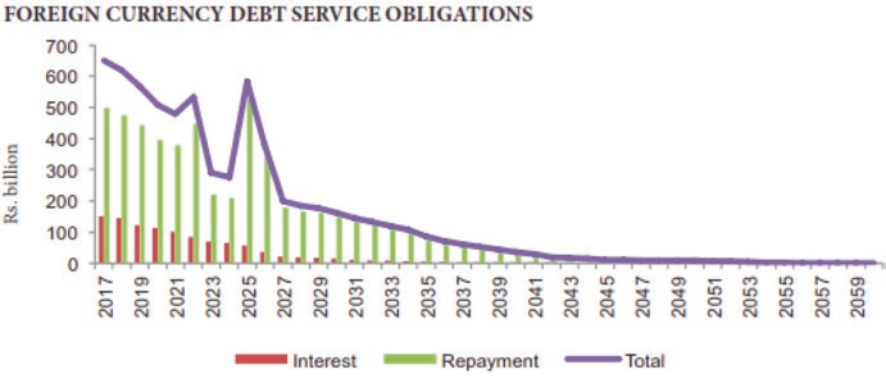

Fig. 15.4 Foreign currency debt service obligations. (Source: Public Debt Department, CBSL- 2017)

Table 15.3 Debt service payment comparison

Year	Government revenue (Rs.Bn)	Debt service payment (Rs.Bn)	Ratio
2014	1205	1076	89.34%
2015	1461	1318	90.60%
2016	1694	1352	80.20%
2017	1832	1603	87.5%

Source: Author's analysis

Null hypothesis (Ho) = Inflation does not Granger-cause debt
Alternative hypothesis (H1) = Inflation does Granger-cause debt

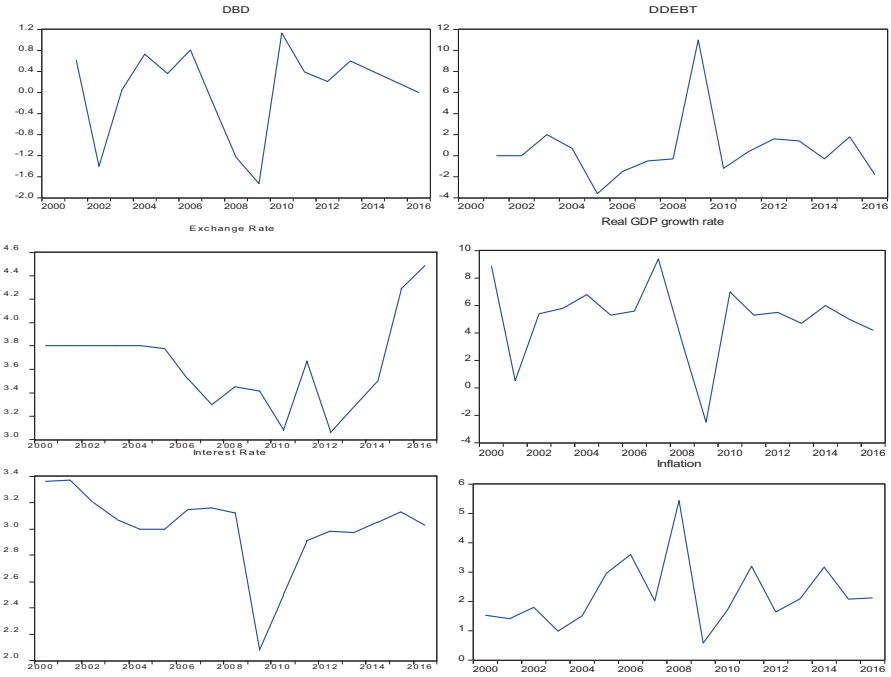

Fig. 15.5 Variables' behaviour for Malaysia, 2000–2016. (Source: Estimates from E-Views Econometric package)

Table 15.4 Comparison of Lag (1) and Lag (2) models

	Lag (1)	Lag (2)
AIC	13.11	1.53
SC	15.09	2.12

Source: Author's analysis

Table 15.5 Pairwise Granger Causality test

Null hypothesis:	Obs	F-statistic	Prob.
INFLATION does not Granger-cause DDEBT	14	6.75697	0.0161
DDEBT does not Granger-cause INFLATION		4.58514	0.0424

Source: Estimates from E-Views Econometric package

15.4.6 Empirical Analysis for South Korea, 2000–2016

In this section, the paper considers the empirical analysis of the selected variables for South Korea from 2000 to 2016. Figure 15.6 presents all selected variables' behaviour at the stationary level.

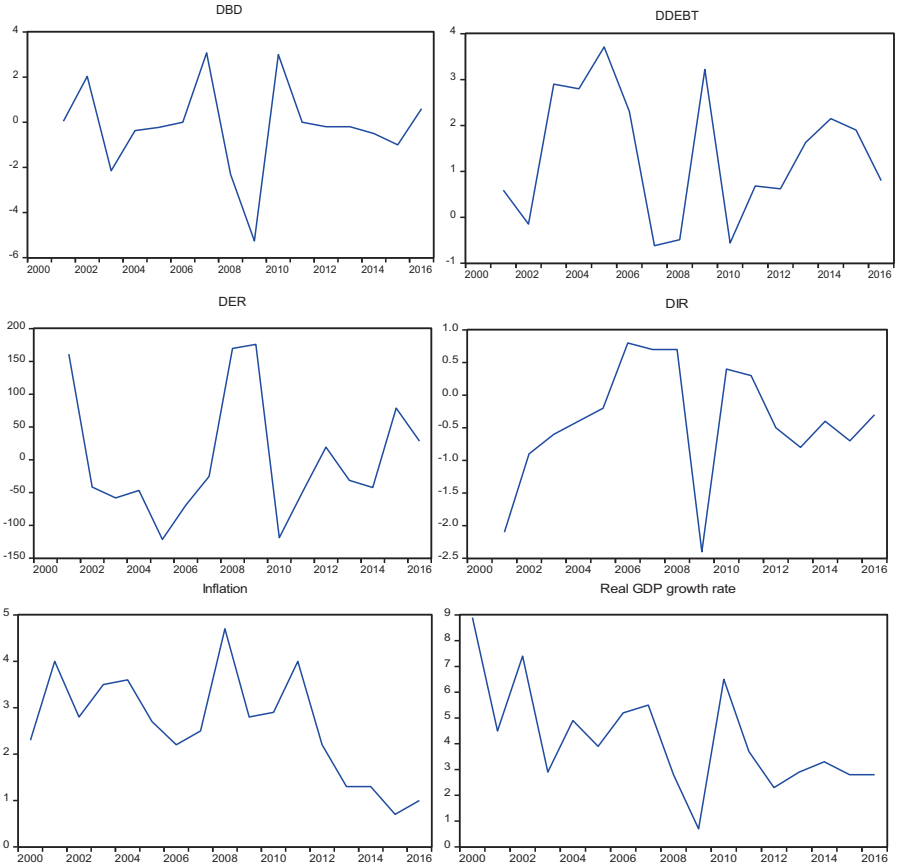

Fig. 15.6 Variables' behaviour in South Korea, 2000–2016. (Source: Estimates from E-Views Econometric package)

15.4.7 Lag Selection Criterion

According to Table 15.6, the lowest AIC (Akaike info criterion) and SC (Schwarz criterion) values belong to the Lag (2) model. Therefore we applied the Lag (2) model for the data analysis in the study.

In Table 15.7, the probability value 0.0231 is less than 0.05 (5%); hence we reject the null hypothesis and conclude that budget deficit Granger-causes exchange rates. Similarly, this study identified a relationship between budget deficit and real GDP growth rate: budget deficit Granger-causes real GDP growth rate. There were five uni-directional causalities between independent variables: debt Granger-causes exchange rate, debt Granger-causes interest rates, debt Granger-causes real GDP growth rate, exchange rate Granger-causes interest rate and inflation Granger-causes exchange rate (see Table 15.12, Appendix 15.3).

Table 15.6 Comparison of Lag (1) and Lag (2) models

	Lag (1)	Lag (2)
AIC	19.32	1.79
SC	21.30	2.38

Source: Author's analysis

Table 15.7 Pairwise Granger Causality test

Null hypothesis:	Obs	F-statistic	Prob.
DER does not Granger-cause DBD	14	2.25976	0.1602
DBD does not Granger-cause DER		5.89216	0.0231

Source: Estimates from E-Views Econometric package

Null hypothesis (Ho) = Budget deficit does not Granger-cause exchange rate
Alternative hypothesis (H1) = Budget deficit does Granger-cause exchange rate

15.4.8 Hausman Test

In the panel data series, the Hausman test evaluates the most suitable model to proceed from the fixed-effect and random-effect models. In Table 15.8, the probability value of the Hausman test is 0.0263, and this value is less than 0.05 (5%). Therefore we reject the null hypothesis and accept the alternative hypothesis. We conclude that the fixed-effect model is appropriate for the data analysis.
Null hypothesis (H0) = Random-effect model is appropriate
Alternative hypothesis (H1) = Fixed-effect model is appropriate

We utilized the fixed-effect model for data analysis. Table 15.9 shows that debts and real GDP growth rate probability values are, respectively, 0.001 and 0.0234. These selected values are less than 0.05. Therefore, we can conclude that debt and real GDP growth rate are significant variables in explaining the budget deficit.

The outcomes in Table 15.9: when identifying the link to prominent economic theories with debt, real GDP growth rate and budget deficit, the coefficient value of debt is −0.0946, and this minus sign represents the inverse relationship between budget deficit and debt. When a government decides to reduce its deficit while issuing debt securities, this may lead to accumulating debt stock level. In Keynesian theory, this circumstance is clearly emphasized. After considering the debt variable coefficient value (0.0946), the ratio between budget deficit and debt is 1:9 (*Bd*: debts = 1:9); this shows that, when the government decides to reduce its debt level by 9%, the deficit will increase by only 1%. A coefficient value of the real GDP growth rate is 0.185183, and this positive sign addresses Keynesian demand management theory: when government tends to increase expenditure while reducing taxes, with an objective of increasing GDP, this will lead to increase in the size of the budget deficit. According to Table 15.9, the ratio between budget deficit and real GDP growth rate is 1:18; this will appear when the government decides to increase GDP growth rate by 18%, so that the deficit will increase only by 1%.

Table 15.8 Hausman Test

Correlated random effect – Hausman test			
Test summary	Chi-Sq. statistic	Chi-Sq. d.f.	Prob.
Period random	12.704746	5	0.0263

Source: Estimates from E-Views Econometric package

Table 15.9 Fixed-effect model of Hausman test

Dependent variable: BUDGET_DEFICIT				
Variable	Coefficient	Std. error	t-statistic	Prob.
C	2.686242	2.149230	1.249862	0.2181
DEBTS	−0.094644	0.021956	−4.310709	0.0001
EXCHANGE_RATE	−0.005951	0.003090	−1.926280	0.0607
INFLATION	0.080128	0.077342	1.036019	0.3060
INTEREST_RATE	−0.051042	0.089169	−0.572416	0.5700
REAL_GDP_GROWTH_RATE	0.185183	0.078783	2.350553	0.0234

Source: Estimates from E-Views Econometric package

15.5 Conclusion and Recommendation

This paper examined the nexus between selected macroeconomic variables (inflation, interest rates, exchange rates, debt and real GDP growth rate) and the budget deficit from 2000 to 2016 and considered Sri Lanka, Malaysia and South Korea for comparative study.

The Sri Lankan finding suggested there were uni-directional causalities between budget deficit and debt, interest rates and budget deficit and inflation and budget deficit. Moreover, budget deficit Granger-causes debt, interest rates Granger-cause budget deficit and inflation Granger-causes budget deficit. In the Malaysian study, there were no relationships between the selected macroeconomic variables and budget deficit. The South Korean study found uni-directional causality between budget deficit and exchange rate and budget deficit and real GDP growth rate: budget deficit Granger-causes exchange rates, and budget deficit Granger-causes real GDP growth rate.

When implementing panel analysis for the comparative study, the test results revealed debt and real GDP growth rate were the two significant variables for explaining budget deficit. This observation suggested that debt and real GDP growth rate were the two significant variables in controlling the budget deficit. According to the statistical record, Malaysia and South Korea maintained a lower debt ratio level; consequently these two countries' budget deficits were also at a low level. Sri Lanka recorded a higher debt ratio level, and the country's budget deficit was also at a high level. Statistical data also show that a country's debt is a significant variable in managing the size of its budget deficit.

For a country like Sri Lanka, it is important to consider debt level in reducing the budget deficit and economic policy strategies adopted and how these were implemented by Malaysia and South Korea, in order to mitigate prevailing economic

issues: sustained sizable budget deficits, significant debt maturities, weaker public finances and higher domestic and foreign currency debt portion. These are the main issues faced currently in achieving sustained economic growth.

Appendices

Appendix 15.1: Statistical Data for Sri Lanka, 1980–2016

Years	Budget deficits (% of GDP)	Inflation (CCPI %)	Interest rate (91 days T-bill rate)	Exchange rate (USD)	Real GDP growth rate (% of GDP)	Debt (% of GDP)
1980	−19.2	26.1	13	16.53	5.8	77.2
1981	−12.4	18	13	19.25	5.8	76.1
1982	−14	10.8	13	20.81	5.1	81.2
1983	−10.6	14	12	23.53	5	81
1984	−6.8	16.6	14	25.44	5.1	68.5
1985	−9.7	1.5	11.5	27.16	5	80.2
1986	−10.1	8	11.31	28.02	4.3	86.8
1987	−8.7	7.7	10.77	29.45	1.5	97
1988	−12.7	14	18.86	31.81	2.7	101
1989	−8.6	11.6	18.1	36.05	2.3	108.7
1990	−7.8	21.5	17.41	40.06	6.2	96.6
1991	−9.8	12.2	16.33	41.37	4.6	98.5
1992	−6.1	11.4	17.67	43.83	4.3	95.4
1993	−7.1	11.7	18.09	48.25	6.9	96.9
1994	−9.1	8.4	18.73	49.42	5.6	95.1
1995	−8.7	7.7	19.26	51.25	5.5	95.2
1996	−8.4	15.9	17.45	55.27	3.8	93.3
1997	−7	9.6	9.97	58.99	6.3	85.8
1998	−8.4	9.4	12.01	64.59	4.7	90.8
1999	−6.9	4.7	11.79	70.39	4.3	95.1
2000	−9.5	6.2	17.77	75.78	6	96.9
2001	−10.4	14.2	12.92	89.36	−1.5	103.3
2002	−8.5	9.6	9.92	95.66	4	105.6
2003	−7.3	6.3	7.35	96.52	5.9	102.3
2004	−7.5	9	7.25	101.19	5.4	102.3
2005	−7	11	10.1	100.5	6.2	90.6
2006	−7	10	12.76	103.96	7.7	87.9
2007	−6.9	15.8	21.3	110.62	6.8	85
2008	−7	22.6	17.33	108.33	6	81.4
2009	−9.9	3.5	7.73	114.94	3.5	86.2
2010	−8	6.2	7.24	113.06	8	81.9
2011	−6.9	6.7	8.68	110.57	8.2	78.5

(continued)

Years	Budget deficits (% of GDP)	Inflation (CCPI %)	Interest rate (91 days T-bill rate)	Exchange rate (USD)	Real GDP growth rate (% of GDP)	Debt (% of GDP)
2012	−6.5	7.6	10	127.6	6.3	79.2
2013	−5.9	6.9	7.54	129.11	7.2	78.3
2014	−6	3.3	5.74	130.56	7.4	75.5
2015	−7.6	2.2	6.45	135.94	4.8	77.6
2016	−5.4	4	8.72	145.6	4.4	79.3

Source: CBSL, Annual Reports

Appendix 15.2: Statistical Data for Sri Lanka, Malaysia and South Korea, 2000–2016

Country	Year	Budget deficit	Inflation	Interest rate	Exchange rate	Real GDP	Debts
Sri Lanka	2000	−9.5	6.2	17.77	75.78	6	96.9
Sri Lanka	2001	−10.4	14.2	12.92	89.36	−1.5	103.3
Sri Lanka	2002	−8.5	9.6	9.92	95.66	4	105.6
Sri Lanka	2003	−7.3	6.3	7.35	96.52	5.9	102.3
Sri Lanka	2004	−7.5	9	7.25	101.19	5.4	102.3
Sri Lanka	2005	−7	11	10.1	100.5	6.2	90.6
Sri Lanka	2006	−7	10	12.76	103.96	7.7	87.9
Sri Lanka	2007	−6.9	15.8	21.3	110.62	6.8	85
Sri Lanka	2008	−7	22.6	17.33	108.33	6	81.4
Sri Lanka	2009	−9.9	3.5	7.73	114.94	3.5	86.2
Sri Lanka	2010	−7	6.2	7.24	113.06	8	71.6
Sri Lanka	2011	−6.2	6.7	8.68	110.57	8.4	71.1
Sri Lanka	2012	−5.6	7.6	10	127.6	9.1	68.7
Sri Lanka	2013	−5.4	6.9	7.54	129.11	3.4	70.8
Sri Lanka	2014	−5.7	3.3	5.74	130.56	5	71.3
Sri Lanka	2015	−7.6	2.2	6.45	135.94	4.8	77.6
Sri Lanka	2016	−5.4	4	8.72	145.6	4.4	79.3
Malaysia	2000	−4.12	1.53	3.36	3.8	8.9	43
Malaysia	2001	−3.5	1.41	3.37	3.8	0.52	43
Malaysia	2002	−4.9	1.8	3.2	3.8	5.4	43
Malaysia	2003	−4.85	0.99	3.07	3.8	5.8	45
Malaysia	2004	−4.12	1.51	3	3.8	6.8	45.7
Malaysia	2005	−3.76	2.96	3	3.78	5.3	42.1
Malaysia	2006	−2.95	3.6	3.15	3.52	5.6	40.6
Malaysia	2007	−3.17	2.02	3.16	3.3	9.4	40.1
Malaysia	2008	−4.4	5.44	3.12	3.45	3.3	39.8

(continued)

Country	Year	Budget deficit	Inflation	Interest rate	Exchange rate	Real GDP	Debts
Malaysia	2009	−6.13	0.58	2.08	3.42	−2.5	50.8
Malaysia	2010	−5	1.71	2.5	3.08	7	49.6
Malaysia	2011	−4.61	3.2	2.91	3.67	5.3	50
Malaysia	2012	−4.4	1.64	2.98	3.06	5.5	51.6
Malaysia	2013	−3.8	2.09	2.97	3.28	4.7	53
Malaysia	2014	−3.4	3.17	3.05	3.5	6	52.7
Malaysia	2015	−3.2	2.08	3.13	4.29	5	54.5
Malaysia	2016	−3.2	2.12	3.03	4.49	4.2	52.7
South Korea	2000	1.08	2.3	7.9	1130.90	8.9	17.11
South Korea	2001	1.12	4	5.8	1292.01	4.5	17.7
South Korea	2002	3.15	2.8	4.9	1250.31	7.4	17.55
South Korea	2003	1	3.5	4.3	1192.08	2.9	20.45
South Korea	2004	0.63	3.6	3.9	1145.24	4.9	23.25
South Korea	2005	0.4	2.7	3.7	1023.75	3.9	26.96
South Korea	2006	0.4	2.2	4.5	954.32	5.2	29.27
South Korea	2007	3.47	2.5	5.2	928.97	5.5	28.65
South Korea	2008	1.16	4.7	5.9	1098.71	2.8	28.16
South Korea	2009	−4.1	2.8	3.5	1274.63	0.7	31.38
South Korea	2010	−1.1	2.9	3.9	1155.74	6.5	30.82
South Korea	2011	−1.1	4	4.2	1106.94	3.7	31.5
South Korea	2012	−1.3	2.2	3.7	1126.16	2.3	32.12
South Korea	2013	−1.5	1.3	2.9	1094.67	2.9	33.75
South Korea	2014	−2	1.3	2.5	1052.29	3.3	35.9
South Korea	2015	−3	0.7	1.8	1130.96	2.8	37.8
South Korea	2016	−2.4	1	1.5	1159.34	2.8	38.6

Source: The World Factbook

Appendix 15. 3: EViews Statistical Output

Table 15.10 Pairwise Granger Causality tests for all variables – Sri Lanka, 2000–2016

Pairwise Granger Causality tests			
Date: 09/05/18 Time: 12:58			
Sample: 2000 2016			
Lags: 2			
Null hypothesis:	Obs	F-statistic	Prob.
DDEBTS does not Granger-Cause BUDGET_DEFICIT	14	0.24862	0.7851
BUDGET_DEFICIT does not Granger-Cause DDEBTS		6.05289	0.0216
DER does not Granger-Cause BUDGET_DEFICIT	14	0.82632	0.4683
BUDGET_DEFICIT does not Granger-Cause DER		0.87243	0.4505
DIR does not Granger-Cause BUDGET_DEFICIT	14	4.33379	0.0481
BUDGET_DEFICIT does not Granger-Cause DIR		0.69782	0.5227
INFLATION does not Granger-Cause BUDGET_DEFICIT	15	6.22820	0.0175
BUDGET_DEFICIT does not Granger-Cause INFLATION		0.07295	0.9301
REAL_GDP_GROWTH_RATE does not Granger-Cause BUDGET_DEFICIT	15	0.27676	0.7639
BUDGET_DEFICIT does not Granger-Cause REAL_GDP_GROWTH_RATE		1.07370	0.3781
DER does not Granger-Cause DDEBTS	14	0.18234	0.8363
DDEBTS does not Granger-Cause DER		1.88703	0.2068
DIR does not Granger-Cause DDEBTS	14	1.61932	0.2508
DDEBTS does not Granger-Cause DIR		2.51331	0.1358
INFLATION does not Granger-Cause DDEBTS	14	1.87513	0.2086
DDEBTS does not Granger-Cause INFLATION		0.61945	0.5597
REAL_GDP_GROWTH_RATE does not Granger-Cause DDEBTS	14	0.75709	0.4967
DDEBTS does not Granger-Cause REAL_GDP_GROWTH_RATE		4.53868	0.0433
DIR does not Granger-Cause DER	14	0.66011	0.5401
DER does not Granger-Cause DIR		1.06879	0.3833
INFLATION does not Granger-Cause DER	14	0.29129	0.7541
DER does not Granger-Cause INFLATION		0.80341	0.4775
REAL_GDP_GROWTH_RATE does not Granger-Cause DER	14	0.11055	0.8965
DER does not Granger-Cause REAL_GDP_GROWTH_RATE		1.70248	0.2360
INFLATION does not Granger-Cause DIR	14	1.94935	0.1980
DIR does not Granger-Cause INFLATION		18.7791	0.0006
REAL_GDP_GROWTH_RATE does not Granger-Cause DIR	14	0.09866	0.9070
DIR does not Granger-Cause REAL_GDP_GROWTH_RATE		1.95374	0.1974
REAL_GDP_GROWTH_RATE does not Granger-Cause INFLATION	15	0.32722	0.7284
INFLATION does not Granger-Cause REAL_GDP_GROWTH_RATE		0.70733	0.5160

Table 15.11 Pairwise Granger Causality tests for all variables – Malaysia, 2000–2016

Pairwise Granger Causality tests			
Date: 09/07/18 Time: 12:47			
Sample: 2000 2016			
Lags: 2			
Null hypothesis:	Obs	F-statistic	Prob.
DDEBT does not Granger-Cause DBD	14	2.00415	0.1906
DBD does not Granger-Cause DDEBT		3.36743	0.0809
EXCHANGE_RATE does not Granger-Cause DBD	14	0.24323	0.7891
DBD does not Granger-Cause EXCHANGE_RATE		0.59025	0.5743
INFLATION does not Granger-Cause DBD	14	3.46719	0.0765
DBD does not Granger-Cause INFLATION		1.94765	0.1982
INTEREST_RATE does not Granger-Cause DBD	14	3.41098	0.0790
DBD does not Granger-Cause INTEREST_RATE		4.04870	0.0557
REAL_GDP_GROWTH_RATE does not Granger-Cause DBD	14	3.58834	0.0715
DBD does not Granger-Cause REAL_GDP_GROWTH_RATE		2.15980	0.1713
EXCHANGE_RATE does not Granger-Cause DDEBT	14	1.12881	0.3652
DDEBT does not Granger-Cause EXCHANGE_RATE		1.82346	0.2164
INFLATION does not Granger-Cause DDEBT	14	6.75697	0.0161
DDEBT does not Granger-Cause INFLATION		4.58514	0.0424
INTEREST_RATE does not Granger-Cause DDEBT	14	0.04439	0.9568
DDEBT does not Granger-Cause INTEREST_RATE		0.02577	0.9746
REAL_GDP_GROWTH_RATE does not Granger-Cause DDEBT	14	1.11594	0.3690
DDEBT does not Granger-Cause REAL_GDP_GROWTH_RATE		1.33015	0.3118
INFLATION does not Granger-Cause EXCHANGE_RATE	15	0.55177	0.5925
EXCHANGE_RATE does not Granger-Cause INFLATION		0.45948	0.6443
INTEREST_RATE does not Granger-Cause EXCHANGE_RATE	15	0.42780	0.6633
EXCHANGE_RATE does not Granger-Cause INTEREST_RATE		0.85120	0.4556
REAL_GDP_GROWTH_RATE does not Granger-Cause EXCHANGE_RATE	15	1.25942	0.3252
EXCHANGE_RATE does not Granger-Cause REAL_GDP_GROWTH_RATE		0.69463	0.5218
INTEREST_RATE does not Granger-Cause INFLATION	15	0.88380	0.4432
INFLATION does not Granger-Cause INTEREST_RATE		5.40783	0.0256
REAL_GDP_GROWTH_RATE does not Granger-Cause INFLATION	15	3.72079	0.0620
INFLATION does not Granger-Cause REAL_GDP_GROWTH_RATE		1.21012	0.3383
REAL_GDP_GROWTH_RATE does not Granger-Cause INTEREST_RATE	15	0.88830	0.4415
INTEREST_RATE does not Granger-Cause REAL_GDP_GROWTH_RATE		0.04134	0.9597

Table 15.12 Pairwise Granger Causality tests for all variables – South Korea, 2000–2016

Pairwise Granger Causality tests			
Date: 04/30/18 Time: 14:16			
Sample: 2000 2016			
Lags: 2			
Null hypothesis:	Obs	F-statistic	Prob.
DDEBT does not Granger-Cause DBD	14	1.94567	0.1985
DBD does not Granger-Cause DDEBT		0.34266	0.7187
DER does not Granger-Cause DBD	14	2.25976	0.1602
DBD does not Granger-Cause DER		5.89216	0.0231
DIR does not Granger-Cause DBD	14	0.05770	0.9443
DBD does not Granger-Cause DIR		2.73019	0.1184
INFLATION does not Granger-Cause DBD	14	1.24016	0.3344
DBD does not Granger-Cause INFLATION		2.38699	0.1473
REAL_GDP_GROWTH_RATE does not Granger-Cause DBD	14	0.22601	0.8021
DBD does not Granger-Cause REAL_GDP_GROWTH_RATE		7.06087	0.0143
DER does not Granger-Cause DDEBT	14	0.32254	0.7323
DDEBT does not Granger-Cause DER		5.76029	0.0245
DIR does not Granger-Cause DDEBT	14	1.77165	0.2245
DDEBT does not Granger-Cause DIR		5.05693	0.0337
INFLATION does not Granger-Cause DDEBT	14	0.51306	0.6152
DDEBT does not Granger-Cause INFLATION		1.76757	0.2252
REAL_GDP_GROWTH_RATE does not Granger-Cause DDEBT	14	0.67803	0.5318
DDEBT does not Granger-Cause REAL_GDP_GROWTH_RATE		6.17592	0.0205
DIR does not Granger-Cause DER	14	4.85440	0.0371
DER does not Granger-Cause DIR		4.99128	0.0348
INFLATION does not Granger-Cause DER	14	4.62704	0.0415
DER does not Granger-Cause INFLATION		1.44651	0.2853
REAL_GDP_GROWTH_RATE does not Granger-Cause DER	14	1.29382	0.3207
DER does not Granger-Cause REAL_GDP_GROWTH_RATE		1.49074	0.2759
INFLATION does not Granger-Cause DIR	14	2.14341	0.1733
DIR does not Granger-Cause INFLATION		0.63482	0.5522
REAL_GDP_GROWTH_RATE does not Granger-Cause DIR	14	1.01523	0.4003
DIR does not Granger-Cause REAL_GDP_GROWTH_RATE		0.96214	0.4181
REAL_GDP_GROWTH_RATE does not Granger-Cause INFLATION	15	2.34294	0.1464
INFLATION does not Granger-Cause REAL_GDP_GROWTH_RATE		1.02800	0.3926

Table 15.13 Hausman test (detailed)

Correlated random effects – Hausman test				
Equation: untitled				
Test period random effects				
Test summary		Chi-Sq. statistic	Chi-Sq. d.f.	Prob.
Period random		12.704746	5	0.0263
** WARNING: estimated period random effects variance is zero.				
Period random effects test comparisons:				
Variable	Fixed	Random	Var(Diff.)	Prob.
DEBTS	−0.079940	−0.105152	0.000004	0.0001
REAL_GDP_GROWTH_RATE	−0.066206	0.059786	0.000174	0.0234
EXCHANGE_RATE	0.002018	0.001464	0.000473	0.0607
INFLATION	−0.103599	−0.016585	0.009158	0.3632
INTEREST_RATE	0.052142	0.110778	0.007330	0.4934

Table 15.14 Fixed effect model (detailed)

Dependent variable: BUDGET_DEFICIT				
Method: panel least squares				
Date: 09/26/18 Time: 08:04				
Sample: 2000 2016				
Periods included: 17				
Cross-sections included: 3				
Total panel (balanced) observations: 51				
Variable	Coefficient	Std. error	t-statistic	Prob.
C	2.686242	2.149230	1.249862	0.2181
DEBTS	−0.094644	0.021956	−4.310709	0.0001
EXCHANGE_RATE	−0.005951	0.003090	−1.926280	0.0607
INFLATION	0.080128	0.077342	1.036019	0.3060
INTEREST_RATE	−0.051042	0.089169	−0.572416	0.5700
REAL_GDP_GROWTH_RATE	0.185183	0.078783	2.350553	0.0234
Effects specification				
Cross-section fixed (dummy variables)				
R-squared	0.887707	Mean dependent var		−3.872549
Adjusted R-squared	0.869427	S.D. dependent var		3.287514
S.E. of regression	1.187939	Akaike info criterion		3.325417
Sum squared resid	60.68154	Schwarz criterion		3.628448
Log likelihood	−76.79812	Hannan-Quinn criter.		3.441214
F-statistic	48.56115	Durbin-Watson stat		1.049976
Prob (F-statistic)	0.000000			

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